# mail

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# Buffer with Open Drain Output

The NL17SG07E MiniGate<sup>™</sup> is an advanced high–speed CMOS Buffer with Open Drain Output in ultra–small footprint.

The NL17SG07E input and output structures provide protection when voltages up to 3.6 V are applied regardless of the supply voltage.

# Features

- Wide Operating  $V_{CC}$  Range: 0.9 V to 3.6 V
- High Speed:  $t_{PD} = 2.5$  ns (Typ) at  $V_{CC} = 3.0$  V,  $C_L = 15$  pF
- Low Power Dissipation:  $I_{CC} = 0.5 \ \mu A \ (Max)$  at  $T_A = 25^{\circ}C$
- 3.6 V Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra-Small Packages
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant



(Top View)



Figure 2. Logic Symbol



# **ON Semiconductor®**

www.onsemi.com



M = Date Code\* = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

#### **PIN ASSIGNMENT**

PIN	NAME
1	NC
2	А
3	GND
4	Y
5	V <sub>CC</sub>

## FUNCTION TABLE

Input A	Output Y
L	L
Н	Z

## **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +4.6	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to +4.6	V
V <sub>OUT</sub>	DC Output Voltage Active Mode, LOW State Tri–State Mode, Output at Hi–Z State Power–Down Mode (V <sub>CC</sub> = 0 V)	$\begin{array}{c} -0.5 \text{ to } V_{CC} + 0.5 \\ -0.5 \text{ to } +4.6 \\ -0.5 \text{ to } +4.6 \end{array}$	V
I <sub>IK</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-20	mA
I <sub>OK</sub>	DC Output Diode Current V <sub>OUT</sub> < GND	-20	mA
I <sub>OUT</sub>	DC Output Source/Sink Current	±20	mA
I <sub>CC</sub>	DC Supply Current per Supply Pin	±20	mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	±20	mA
T <sub>STG</sub>	Storage Temperature Range	−65 to +150	°C
ΤL	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
ТJ	Junction Temperature Under Bias	+150	°C
MSL	Moisture Sensitivity	Level 1	
F <sub>R</sub>	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage Human Body Model (Note 2)	>2000	V
ILATCHUP	Latch-up Performance above $V_{CC}$ and below GND at 125°C (Note 3)	±75	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
 Tested to EIA/JESD22-A114-A.

3. Tested to EIA/JESD78.

# **RECOMMENDED OPERATING CONDITIONS**

Symbol	Characteristics	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	0.9	3.6	V
V <sub>IN</sub>	Digital Input Voltage	0.0	3.6	V
V <sub>OUT</sub>	Output Voltage Output at Low State Tri–State Mode, Output at Hi–Z State Power–Down Mode (V <sub>CC</sub> = 0 V)	0.0 0.0 0.0	V <sub>CC</sub> 3.6 3.6	V
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
$\Delta t / \Delta V$	Input Transition Rise or Fail Rate $$V_{CC}$$ = 3.3 V $\pm$ 0.3 V	0	10	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

# DC ELECTRICAL CHARACTERISTICS

				Vee	T <sub>A</sub> = 25°C -5		–55°C ≤ T	°C ≤ T <sub>A</sub> ≤ 125°C				
Symbol	Parameter	с	ondition	(V)	Min	Тур	Max	Min	Max	Unit		
VIH	High-Level			0.9	V <sub>CC</sub>			V <sub>CC</sub>				
	input voltage					1.1 to 1.3	0.70 x V <sub>CC</sub>			0.70 x V <sub>CC</sub>		
				1.4 to 1.6	0.65 x V <sub>CC</sub>			0.65 x V <sub>CC</sub>		V		
				1.65 to 1.95	0.65 x V <sub>CC</sub>			0.65 x V <sub>CC</sub>				
				2.3 to 2.7	1.7			1.7				
				3.0 to 3.6	2.0			2.0				
VIL	Low-Level			0.9			GND		GND			
	input voltage			1.1 to 1.3			0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>			
			1.4 to 1.6			0.35 x V <sub>CC</sub>		0.35 x V <sub>CC</sub>	v			
			1.65 to 1.95			0.35 x V <sub>CC</sub>		0.35 x V <sub>CC</sub>				
				2.3 to 2.7			0.7		0.7			
				3.0 to 3.6			0.8		0.8			
V <sub>OL</sub>	Low-Level	V <sub>IN</sub> =	I <sub>OL</sub> = 20 μA	0.9			0.1		0.1	V		
	Output voltage	V <sub>IH</sub> or V <sub>IL</sub>	l <sub>OL</sub> = 0.3 mA	1.1 to 1.3			0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>			
			l <sub>OL</sub> = 1.7 mA	1.4 to 1.6			0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>			
			I <sub>OL</sub> = 3.0 mA	1.65 to 1.95			0.45		0.45			
			I <sub>OL</sub> = 4.0 mA	2.3 to 2.7			0.4		0.4			
			I <sub>OL</sub> = 8.0 mA	3.0 to 3.6			0.4		0.4			
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 0 to 3.6 V		0.9 to 3.6			±0.1		±1.0	μΑ		
Icc	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND		3.6			0.5		10	μΑ		
I <sub>OZ</sub>	Output Tri- State Leakage Current	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 0 to 3.6 V		0.9 to 3.6			1.0		10	μΑ		
I <sub>OFF</sub>	Power Off Leakage Cur- rent	V <sub>IN</sub> = 0 to 3.6 V V <sub>OUT</sub> = 0 to 3.6 V		0			1.0		10	μA		

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ )

					T <sub>A</sub> = 25°C			T <sub>A</sub> = -55°C to +125°C	
Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	Min	Тур	Max	Min	Max	Unit
t <sub>PZL</sub> Propagation Delay, Enable Time,	Propagation Delay,	$C_{L} = 10 \text{ pF},$	0.9	-	12	-	-	-	ns
	$R_1 = R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	5.5	7.9	-	9.0		
	Alt		1.4 to 1.6	-	4.0	5.7	-	7.3	
			1.65 to 1.95	-	3.3	3.9	-	5.9	
			2.3 to 2.7	-	2.7	3.3	-	4.5	
			3.0 to 3.6	-	2.4	2.9	-	3.7	
		C <sub>L</sub> = 15 pF,	0.9	-	12.5	-	-	-	ns
		$R_1 = R_L = 5 K_{2}$	1.1 to 1.3	-	5.8	8.1	-	9.2	
			1.4 to 1.6	-	4.1	6.0	-	7.4	
			1.65 to 1.95	-	3.4	4.0	-	6.2	
			2.3 to 2.7	-	2.8	3.4	-	4.6	
			3.0 to 3.6	-	2.5	3.0	-	3.7	
		C <sub>L</sub> = 30 pF,	0.9	-	13.2	-	-	-	ns
		$R_1 = R_L = 5 K\Omega_2$	1.1 to 1.3	-	6.2	8.7	-	9.8	-
			1.4 to 1.6	-	4.5	6.2	-	7.6	
			1.65 to 1.95	-	3.5	4.2	-	6.4	
			2.3 to 2.7	-	3.0	3.6	-	4.7	
			3.0 to 3.6	-	2.6	3.1	-	3.9	
t <sub>PLZ</sub>	Propagation Delay,	$C_L = 10 \text{ pF},$ $R_1 = R_L = 5 \text{ k}\Omega$	0.9	-	8.0	-	-	-	ns
	Disable Time,		1.1 to 1.3	-	6.5	10.9	-	11.5	
	Alton		1.4 to 1.6	-	5.2	8.9	-	9.5	
			1.65 to 1.95	-	4.9	8.8	-	9.4	
			2.3 to 2.7	-	3.8	8.4	-	9.3	
			3.0 to 3.6	-	3.5	8.1	-	8.5	
		$C_{L} = 15  pF,$	0.9	-	11.1	-	-	-	
		$R_1 = R_L = 5 K\Omega_2$	1.1 to 1.3	-	9.0	13.4	-	14	
			1.4 to 1.6	-	7.9	11.4	-	12.0	
			1.65 to 1.95	-	7.6	11.3	-	11.9	
			2.3 to 2.7	-	6.3	10.9	-	11.8	1
			3.0 to 3.6	-	6.0	10.6	-	11.0	
		C <sub>L</sub> = 30 pF,	0.9	-	16.2	-	-	-	ns
		$R_1 = R_L = 5 K_{2}$	1.1 to 1.3	-	14	20.2	-	20	
			1.4 to 1.6	-	13	18.9	_	19.5	
			1.65 to 1.95	-	12.5	18.8	-	19.4	
			2.3 to 2.7	-	11.2	18.4	-	19.3	
			3.0 to 3.6	-	11	18.1	-	18.3	]
C <sub>IN</sub>	Input Capacitance		0 to 3.6	-	3	-	_	-	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 4)		0.9 to 3.6	_	4	_	_	-	pF

4.  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the dynamic operating current consumption without load. Average operating current can be obtained by the equation:  $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .







Figure 4. Test Circuit

#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>		
NL17SG07EDFT2G	SC–88A (Pb–Free)	3000 / Tape & Reel		

+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

#### PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353) CASE 419A-02

**ISSUE L** G з. -B- $\oplus$ 0.2 (0.008) M B M 5 PI Ν κ SOLDER FOOTPRINT\* 0.50 0.0197 0.40 0.0157

NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  CONTROLLING DIMENSION: INCH.
- 419A-01 OBSOLETE. NEW STANDARD
- 419A-02
- 4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	INC	HES	MILLIN	ETERS	
DIM	MIN	MAX	MIN	MAX	
Α	0.071	0.087	1.80	2.20	
В	0.045	0.053	1.15	1.35	
С	0.031	0.043	0.80	1.10	
D	0.004	0.012	0.10	0.30	
G	0.026	BSC	0.65 BSC		
Н		0.004		0.10	
J	0.004	0.010	0.10	0.25	
K	0.004	0.012	0.10	0.30	
N	0.008	REF	0.20 REF		
S	0.079	0.087	2.00	2.20	



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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